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(75) Inventors/Applicants (for US only) : DOVE, John [GB/GB]; Park Hill, Pingle Lane, Stone, Staffs. ST3 4BQ (GB). RAHMATALLA, Abdul, Aziz [GB/GB]; 135 Hilton Road, Harpfields, Stoke-on-Trent ST4 6RP (GB). SELL, Philip, John [GB/GB]; 72 Holland Road, Sutton Coldfield, West Midlands B72 1RQ (GB).		With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
(54) Title: PEDICLE ENGAGING MEANS		
(57) Abstract		
<p>Pedicle engaging means comprises a bridge member (10) and two clip members (15); the bridge member having an arched middle portion (11) with concave edges (22) to afford clearance with respect to adjacent spinous processes (23), an aperture (12) in each side of the arch, and a pair of end portions (13) each with a hole for a pedicle screw (29); each clip member (15) having a tip (16) engageable in one of the apertures (12), and a fixing portion (17) with a hole (18) for receiving a pedicle screw (29); and each clip member being cranked (at 19) so as to form with the junction (20) between the arch (11) and respective end portion (13) of the bridge member (10) a pair of clamping parts for embracing a rod or rod-like portion (21') of a spinal fixation device (26).</p>		

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PEDICLE ENGAGING MEANS

This invention relates to pedicle engaging means for use in spinal surgery.

Pedicle screws are well known for use in systems for internal fixation of the spine. However, problems have arisen in attempting to use pedicle screws in systems for segmental spinal fixation. Some pedicle screws need wires to secure them to rods or other devices used for segmental spinal fixation. An alternative which is sometimes used is to make use of plates (instead of rods) or custom built devices. Pedicle screws may be used when there is no lamina present and when consequently methods of sub-lamina wiring are unsuitable.

The object of the present invention is to provide pedicle engaging means particularly suited to use with existing segmental spinal fixation devices such as "Luque rods" or, more particularly, "Hartshill Rectangles" for posterior spinal surgery.

According to the present invention, pedicle engaging means comprises a bridge member having an arched middle portion with an aperture in each side of the arch, and a pair of generally coplanar end portions each with a hole for rotatably receiving a pedicle screw; and a pair of clip members each having a tip engageable in one aperture in the arched portion of the bridge member, and each having a fixing portion with a hole for rotatably receiving a pedicle screw; the hole in a clip member being in register with the hole in the respective end portion of the bridge member when the tip of the clip member is engaged in the respective aperture in

the arched portion of the bridge member, and the portion of the clip member between its tip and its fixing portion being cranked so as to form with the junction between the arched portion and the respective end portion of the bridge member a pair of clamping parts for embracing a rod or rod-like portion of a spinal fixation device.

It is anticipated at present that there are three likely occasions when the pedicle engaging means of the invention will be used:-

1. When there has been a previous extensive wired laminectomy in the lumbar region.

2. When it is necessary to bridge a number of levels and to engage intervening levels particularly to reduce slip in spondylolisthesis.

3. In painful spondylolysis in young patients where at present with sublaminar wiring the level above has to be included in order to gain fixation, whereas with the pedicle engaging means of the invention the internal fixation can be limited to one motion segment.

The bridge member and the two clip members may be formed of any biocompatible material, but a flexible material, such as stainless steel strip, enables the shape of the arched portion to be modified by the surgeons to vary the spacing between the screw holes and/or the alignment of or angularity between the end portions containing the screw holes. However, more than one size of bridge member may be provided, with arched portions of different span and/or height. The width of the arched portion may be reduced between the apertures for

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engagement by the tips of the clip members, e.g., the edges of the arched portion may be concave in plan view to form a neck having its least width at the middle, to afford clearance with respect to adjacent spinous processes.

The holes in the end portions of the bridge member and/or the holes in the fixing portions of the clip members may be elongated in the lengthwise direction of the bridge member, to allow adjustment of the spacing and/or inclination of pedicle screws with respect to the general plane of the end portions of the bridge member. Formation and elongation of the holes may be effected by means of a ball cutter applied to the remote faces of the end portions of the bridge member and the fixing portions of the clip members respectively and moved towards the arched portion of the bridge member and away from the tips of the clip members respectively.

An embodiment of the invention, and the manner of its use, will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a side elevation of the bridge member of pedicle engaging means in accordance with the invention;

Figure 2 is a plan of the bridge member;

Figure 3 is an end elevation of the bridge member;

Figure 4 is a plan view illustrating a method of simultaneously forming two clip members;

Figure 5 is a side elevation of one clip member after bending of its tip;

Figure 6 is an end elevation from the right hand end of Figure 5;

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Figure 7 corresponds to Figure 1 but shows the clip members engaged with the bridge member and rods in place for clamping thereto;

Figure 8 is an enlarged fragmentary section through the right hand end portion of the bridge member and the fixing portion of the corresponding clip member, and indicating the manner of elongating the holes; and

Figure 9 is a perspective view showing the assembly of bridge member and clip members clamped to a "Hartshill Rectangle" and secured by pedicle screws.

In Figures 1 to 3 a bridge member 10 for pedicle engaging means in accordance with the invention has an arched middle portion 11 with an aperture 12 in each side of the arch, and a pair of generally coplanar end portions 13 each with a hole 14 for rotatably receiving a pedicle screw (see Figure 9).

In Figure 4 a pair of clip members 15 are formed simultaneously, each having a tip 16 engageable in one aperture 12 in the arched portion 11 of the bridge member 10 (see Figures 7 and 9) and each having a fixing portion 17 with a hole 18 for rotatably receiving a pedicle screw (again see Figure 9).

Figures 7 and 9 show the tips 16 of the clip members 15 engaged in the apertures 12 in the arched portion 11 of the bridge member 10, the hole 18 in the fixing portion 17 of each clip member being in register with the corresponding hole 14 in the respective end portion 13 of the bridge member, and the portion 19 of each clip member 15 between its tip 16 and its

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fixing portion 17 is cranked so as to form with the junction 20 between the arched portion 11 and the respective end portion 13 of the bridge member 10 a pair of clamping parts for embracing a rod or rod-like portion 21 of a spinal fixation device.

The edges 22 of the arched portion 11 are concave in planview to form a neck having its least width at the middle, to afford clearance with respect to adjacent spinous processes 23 (see Figure 9).

The holes 14, 18 in the end portions 13 of the bridge member 10 and the fixing portions 17 of the clip members 15 respectively are formed and elongated by a ball cutter applied to the remote faces 24, 25 respectively and moved towards the arched portion 11 of the bridge member and away from the tips 16 of the clip portions respectively (as indicated by the arrows in Figure 8).

Figure 9 shows a "Hartshill Rectangle" 26 secured in place on the lower lumber spine by sub-laminar wires 27 at the junctions between the longer sides 21' and the bent shorter sides 28 of the rectangle, and pedicle screws 29 - securing the assembly of the bridge member 10 and clip members 15 to the rectangle and to the spine, the screws 29 passing through the pedicle 30 and into the body of a vertebra 31.

CLAIMS

1. Pedicle engaging means comprising a bridge member having an arched middle portion with an aperture in each side of the arch, and a pair of generally coplanar end portions each with a hole for rotatably receiving a pedicle screw; and a pair of clip members each having a tip engageable in one aperture in the arched portion of the bridge member, and each having a fixing portion with a hole for rotatably receiving a pedicle screw; the hole in a clip member being in register with the hole in the respective end portion of the bridge member when the tip of the clip member is engaged in the respective aperture in the arched portion of the bridge member, and the portion of the clip member between its tip and its fixing portion being cranked so as to form with the junction between the arched portion and the respective end portion of the bridge member a pair of clamping parts for embracing a rod or rod-like portion of a spinal fixation device.

2. Pedicle engaging means as in Claim 1 formed of stainless steel strip.

3. Pedicle engaging means as in Claim 1 or Claim 2, wherein the width of the arched portion of the bridge member is reduced between the apertures for engagement by the tips of the clip members.

4. Pedicle engaging means as in Claim 3, wherein the edges of the arched portion are concave in plan view to form a neck having its least width at the middle.

5. Pedicle engaging means as in any one of Claims 1

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to 4, wherein the holes in the end portions of the bridge member are elongated in the lengthwise direction of the bridge member.

6. Pedicle engaging means as in any one of Claims 1 to 5, wherein the holes in the fixing portions of the clip members are elongated in the lengthwise direction of the bridge member.

7. Pedicle engaging means as in Claim 5 or Claim 6, wherein formation and elongation of the holes is effected by means of a ball cutter applied to the remote faces of the end portions of the bridge member and the fixing portions of the clip members respectively and moved towards the arched portion of the bridge member and away from the tips of the clip members respectively.

8. Pedicle engaging means substantially as hereinbefore described with reference to the accompanying drawings.

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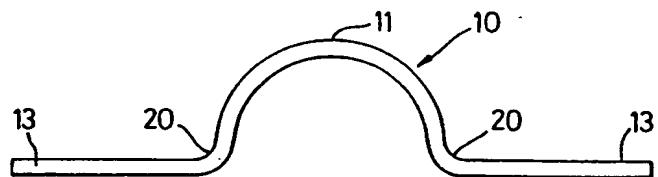


Fig. 1

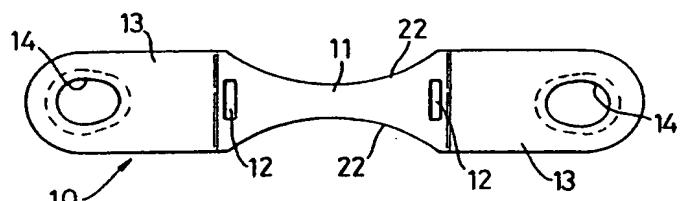


Fig. 2

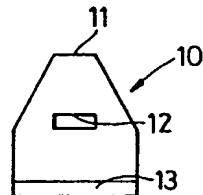


Fig. 3

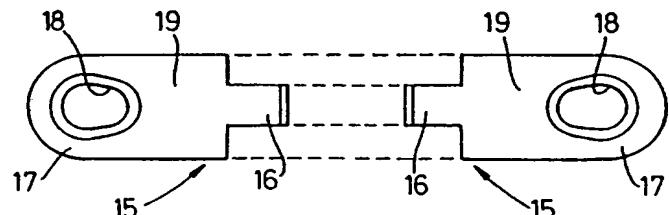


Fig. 4

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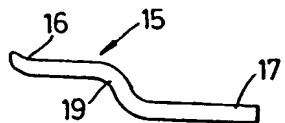


Fig. 5

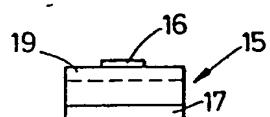


Fig. 6

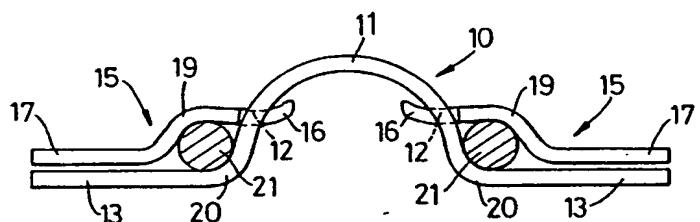


Fig. 7

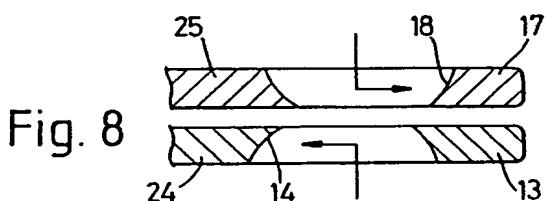


Fig. 8

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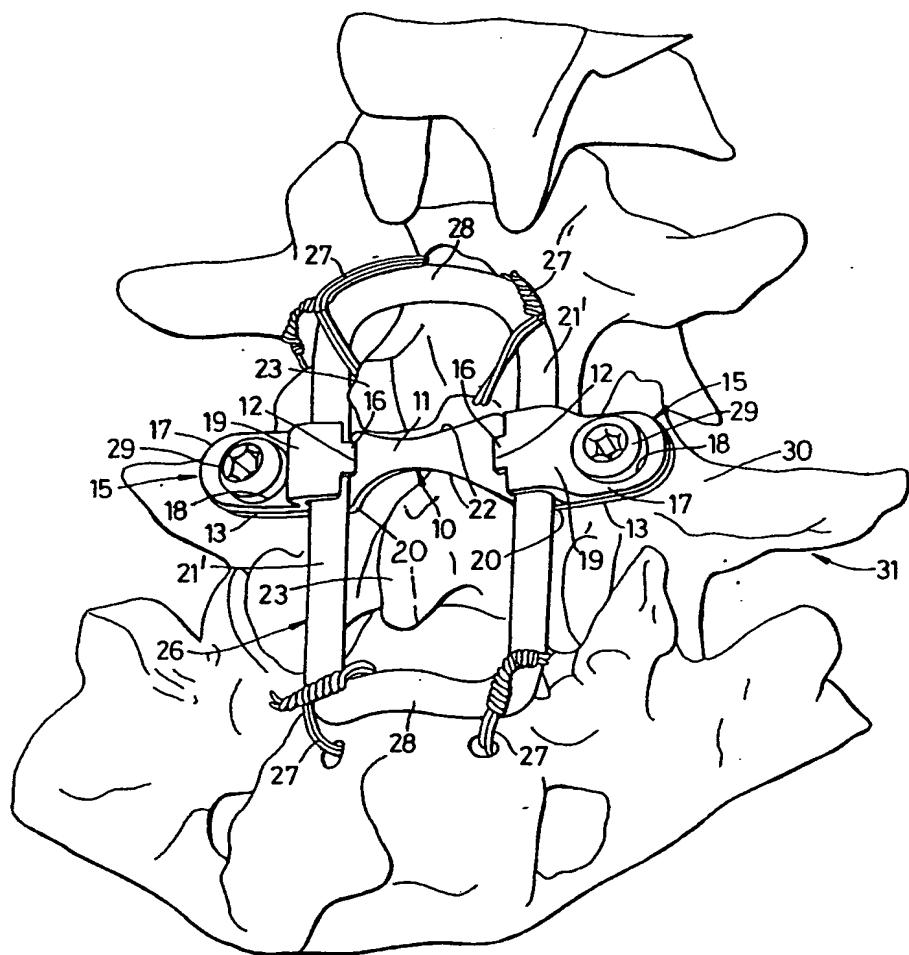


Fig. 9

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INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB 89/01310

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁵ : A 61 B 17/58, A 61 F 5/02		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System ⁸	Classification Symbols	
IPC ⁵	A 61 F, A 61 B, F 16 B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁹		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁰		
Category ¹¹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A US, A, 4648388 (STEFFEE) 10 March 1987, see column 3, lines 21-28; figure 4		1
A EP, A, 0146347 (SURGICRAFT) 26 June 1985, see page 6, line 24 - page 7, line 10; figure 2		1
A DE, U, 8526121 (PSA) 13 February 1986, see figures		1

<p>¹⁰ Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search 26th February 1990	Date of Mailing of this International Search Report 21.3.90	
International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer T.K. WILLIS	

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ANNEX TO THE INTERNATIONAL SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 14/03/90. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 4648388	10-03-87	EP-A-	0220736	06-05-87
		US-A-	4719905	19-01-88
EP-A- 0146347	26-06-85	GB-A,B	2151928	31-07-85
		US-A-	4686970	18-08-87
DE-U- 8526121	02-01-86	None		